INTRODUCTION

Identification of Purpose, Scope, and Authority

This is the Final Fish and Wildlife Coordination Act Report (CAR) for the Ecosystem Revitalization @ Route 66 Project (Project), Albuquerque, New Mexico, prepared by the U.S. Fish and Wildlife Service (Service). This Ecosystem Revitalization @ Route 66 Project is being conducted under the authority of Section 1135 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662). The objective of this authority is to improve the quality of the environment through modification of the structure or operation of existing water resources projects constructed by the US Army Corps of Engineers (USACE), providing modifications that are feasible and consistent with the original project purpose. Improvements in ecosystem structure and function in areas adversely affected by such projects are also included in this CAR. This report has been prepared in cooperation with the.USACE Should project plans change or a considerable amount of time elapse before this project begins to be constructed, impacts on fish and wildlife should be re-examined.

The Rio Grande in New Mexico has been negatively impacted by water diversions, dams, levees, drains, channelization, jetty jacks, and urbanization. Water management has altered the river channel and floodplain, and has altered the flow regime. Willow and cottonwood recruitment has declined, noxious plants have increased in abundance, combustible organic litter has accumulated, wetlands have been lost, and the overall value of aquatic and bosque (Spanish word for woodland or forest) habitat has declined. Urbanization has also impacted the Rio Grande via widespread trash and debris dumping, high-impact recreational use, and human induced bosque fires. In response to these issues, the Middle Rio Grande Conservancy District (MRGCD) initiated a request to the USACE under Section 1135 of the Water Resource Development Act of 1986, as amended, to restore and enhance the Rio Grande bosque ecosystem.

The placement of levees and installation of Kellner jetty jacks for bank stabilization on the Rio Grande and some of its tributaries (Public Law 80-858) have contributed to the degradation of riparian/wetland ecosystem functions and values. Additionally, the completion of the Jemez Dam on the Jemez River in 1953 which was authorized for sediment control (Public Law 80-858), and Cochiti Dam on the Rio Grande, in 1975 authorized for flood and sediment control (Public law 86-645) reduced the frequency and intensity of overbank flooding contributing further to the degradation of riparian ecosystem functions and values of the Middle Rio Grande bosque. All of these projects are part of the comprehensive flood control plan for the Rio Grande watershed authorized in the Flood Control Act of 1948.

The purpose of the Project is to undertake environmental restoration measures to improve the Rio Grande bosque ecosystem function in central Albuquerque. Potential alternatives include removing jetty jacks and non-native vegetation, such as salt cedar, Russian olive and Siberian elm, enhancing existing high-flow channels, outfall wetlands, and other alterations to the

floodplain. Improvements of existing facilities for educational, interpretive and low-impact recreational uses have also been considered in the Route 66 Project.

The MRGCD is the non-federal sponsor for this Project. The MRGCD manages most of the bosque and controls and maintains a system of canals, drainage ways and other facilities along the Middle Rio Grande from Cochiti Dam downstream to the northern boundary of Bosque del Apache National Wildlife Refuge. The City of Albuquerque (COA) Open Space Division (OSD) co-manages the bosque within the Project Area, and is a critical partner in the development and implementation of this preferred alternative. The OSD manages 33,000 acres of bosque in the COA.

The overall goal of the project is to restore the dynamic bosque mosaic of open areas, woodland patches, shrub patches and wet areas. The ecosystem restoration objectives for the project include: 1) enhancement of the native cottonwood community; 2) enhancement and increasing the number of water-related habitat features in the bosque; 3) implement limited measures to rehabilitate some hydraulic connection between the bosque and the river consistent with operational constraints; 4) protect, extend and enhance areas of potential habitat for listed species within the existing bosque; 5) prevent catastrophic fires in the bosque through the reduction of fuel loads identified as hazardous; 6) develop and implement with the sponsor a long-term Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) plan and long-term monitoring strategy; 7) coordinate and integrate related project planning and monitoring with other ongoing restoration and research efforts in the bosque; and 8) increase access and opportunities for education and low-impact recreation that is compatible with ecosystem integrity.

This CAR provides information concerning: 1) the Project Area; 2) fish and wildlife resources; 3) an evaluation of the impacts of the preferred alternative; and 4) a discussion ; and recommendations to avoid or minimize adverse effects and maximize benefits for fish and wildlife resources.

ACKNOWLEDMENT OF INPUT AND COORDINATION

The Project Delivery Team responsible for the planning process included representatives of the MRGCD, OSD and New Mexico State Parks (NMSP) in addition to the USACE and their consultants. As part of identifying the Preferred Alternative, a number of alternative plans were developed by the Project Delivery Team and compared with the "no action alternative," allowing for the ultimate identification of the Recommended Plan or National Ecosystem Restoration (NER) Plan. The NER Plan reasonably maximizes ecosystem restoration benefits compared to costs, considering the cost-effectiveness and incremental cost of implementing other restoration options.

Discussion of Prior Studies and/or Reports

In the late 1980s the Bosque Initiative was begun by representatives of management agencies, including the USACE. This interagency team drafted the Middle Rio Grande Bosque Biological Management Plan (1993) (MRGBBMP), a guiding document for all subsequent restoration projects in the Middle Rio Grande, including the Bosque Revitalization at Route 66 Project. Under the direction of the Bosque Improvement Group (BIG), the Bosque Initiative has continued to provide funding to a number of small research and restoration projects, including the Bosque Ecosystem Monitoring Program (BEMP) at the Rio Grande Restoration site near the Tingley Ponds.

USACE projects currently underway in the area of the Middle Rio Grande bosque include a series of projects known as the Middle Rio Grande Restoration Projects. This initiative comprises four projects as follows: 1) Albuquerque Bio-Park Tingley Ponds and Wetland Restoration (construction completed in October 2005), 2) Middle Rio Grande Bosque Restoration (in Feasibility Study phase), 3) Bosque Revitalization at Route 66, the subject of this report and 4) the Bosque Wildfire Project (ongoing construction since 2004).

The first of these studies, the Albuquerque Biological Park Tingley Ponds and Wetlands Restoration Project (Bio-Park Project), is a Section 1135 Feasibility Project undertaken by the USACE at the request of the COA in 2001 to determine the advisability of rehabilitating the ponds at Tingley Beach and constructing a series of new wetlands within the adjacent bosque. The COA through the Albuquerque Biological Park, was the non-federal Sponsor for that project. The report and environmental assessment for the Bio-Park Project was completed in February 2004. The project's goal is to increase the acreage, quality and diversity of aquatic habitat in Tingley Ponds by constructing a wetlands complex in the adjacent bosque. The USACE completed the construction project in the fall of 2005.

The second of these studies, the Middle Rio Grande Bosque Restoration Study, is a 905b General Investigation Study (the Bosque Restoration Project). It was initiated in spring 2002 to determine if there is a Federal interest in restoring the Rio Grande Bosque in the vicinity of Albuquerque, New Mexico. The Study Area of the Bosque Restoration Project roughly corresponds to the boundaries of the Rio Grande Valley State Park (RGVSP). The sponsor for this project is the MRGCD. The authorization for the Reconnaissance Phase of this study is contained in U.S. House of Representatives Resolution 107-258 for fiscal year 2002. On July 28, 2002, the Reconnaissance Report for this study was approved at the Headquarters of the USACE in Washington, D.C. for funding by Congress. The planning process included considerable community and stakeholder input in developing overall goals, objectives and concepts for future restoration efforts. These concepts were summarized in the Middle Rio Grande Bosque Restoration Supplemental Planning Information Document, which was completed in summer 2003. The feasibility phase for the Bosque Restoration Study began in 2005, and is proposed to be complete in 2008.

The third and present Study is the Ecosystem Revitalization @ Route 66 Project. The Study began at the end of 2002. The area encompassed by the Project is probably the most intensively used area of the bosque within the Middle Rio Grande reach and was identified as a high priority restoration area in the Bosque Restoration Study. The Route 66 Project has incorporated concepts and community input developed during the Bosque Restoration Study. The implementation of the Study would, in turn, provide important guidance for the feasibility phase of the Bosque Restoration Study.

The fourth study is the Bosque Wildfire Project undertaken in the spring of 2004 in response to the bosque fires in summer 2003. The project would reduce the probability of catastrophic fire through removal of access obstacles and increasing the number of access points. The draft environmental assessment was released to the public in July 2004 and was finalized in September 2004.

In addition to these projects, there are several other USACE projects that affect the planning in the Project area. The USACE, in conjunction with the U.S. Bureau of Reclamation and the New Mexico Interstate Stream Commission (NMISC) is engaged in the Upper Rio Grande Water Operations and Procedures Study (URGWOPS). The URGWOPS is providing important parameters for the restoration efforts contemplated in this study, such as baseline vegetation and hydraulic data. The Middle Rio Grande Endangered Species Act Collaborative Program (MRGESACP), in which the USACE is also a participant, is responsible for funding much of the ongoing research and restoration efforts in the Middle Rio Grande to enhance habitat for endangered species. The MRGESACP and URGWOPS, as well as researchers at the University of New Mexico have provided important input for the study. Other projects undertaken by the USACE in alliance with local sponsors at Los Lunas and the Pueblo of Santa Ana have provided important planning and restoration precedents. The Project provides an opportunity to apply much of what has been learned in all of these projects and studies to a comprehensive, large-scale restoration project with high visibility in the community.

DESCRIPTION OF THE STUDY AREA

The Project Area encompasses a small portion of the Middle Rio Grande within the COA, between Bridge Boulevard and Interstate 40, Bernalillo County, New Mexico (Figure 1). The Project's Study Area consists of 3.1 river miles along the Rio Grande stretching north and south from Central Avenue. The north side of the I-40 Bridge is the upstream limit of the Project Study Area, and the south side of the Bridge Boulevard Bridge is the downstream limit. The Project Study Area is bounded on the east and west by the levees and riverside drains, except for a portion of the area north of the Central Avenue bridge on the west side where there is no levee or riverside drain and the boundary is the adjacent bluff.

The Project Study Area includes approximately 643 acres. There are 370 acres within the active river channel and 273 acres of riparian woodlands, or bosque as it is commonly referred to in

New Mexico. With the exception of the northwest corner of the Project Area, the lands are managed by the MRGCD and the COA OSD as part of the RGVSP.

Geomorphology

The previous water projects have had some dramatic effects on the geomorphology of the Middle Rio Grande. For example, since Cochiti Dam was constructed, and to a lesser extent the Jemez Canyon Dam, much of the sediment in the previously turbid Rio Grande now settles out in the reservoirs. The sediment hungry water below the dams has essentially changed the Middle Rio Grande from an aggrading regime to a degrading system and has resulted in an incised channel through much of the area. The reduction of peak flows, however, has had an opposite effect where unregulated tributaries and arroyos such as the Calabacillas Arroyo discharge into the river. Adequate flows are not available to transport the sediment. Sediment deltas are more persistent; they reduce the river gradient upstream tending to increase aggradation and increase the gradient downstream tending to reduce aggradation. These trends are usually localized near the arroyos (USACE 2008).

Another result of the dams has been to reduce peak flows during the spring runoff period. These flood events were key to overbank flooding and river bar creation, which helped renew the cottonwood riparian forest and remaining wetlands. As a result the bosque today experiences less and less inundation compared to pre-dam times. This loss of inundation prevents native plant rejuvenation that once maintained a healthy riparian condition within the bosque (USACE 2008).

As a result of the channelization projects (installation of levees and jetty jacks) the river has become constrained into a single, narrower floodway throughout much of the Middle Rio Grande, resulting in an approximate 85 percent loss of the original floodplain (Earth Reflections 2003). The current floodplain is generally confined to the levees. Historically it was bounded by lower terraces, then by 300 to 500-foot high mesas.

The flood control and drainage projects implemented were widely successful in rejuvenating the declining agricultural communities and providing opportunities for expanding settlements. This occurred, however, at the expense of wetlands and marshes, which were dramatically reduced in number and extent (Berry and Lewis 1997, Crawford *et al.* 1993, Hanson 1997). Although there are several small areas and former side channels that function as seasonal wetlands, there are no longer any wetlands of significant size in the Project Area. These areas occasionally become wet during seasonal runoff events but may or may not be regarded as jurisdictional wetlands however they are part of the current Middle Rio Grande geomorphology. The USACE Bio-Park Project construction approximately 9 acres of wetland habitat within the Project Study Area.

The change in seasonal discharges has also impacted channel-forming processes. Discharge is the dominant variable that affects channel morphology, but sediment transport, channel bed & bank material and other hydraulic factors are also important influences. Historically, the wide

shallow channel was described as a sand-bed stream (Nordin and Beverage 1965) with a braided pattern (Lane and Borland 1953) likely resulting from sediment overload (Woodson 1961). The river followed a pattern of scouring and filling during floods and was in an aggrading regime (accumulating sediment). Flood hazards associated with the aggrading riverbed prompted the building of levees along the floodway. However, the levee system confined the sediment and increased the rate of aggradation in the floodway. Additionally, channel stabilization works which included jetty jacks installed during the 1950s and 1960s contributed to building up and stabilizing the over-bank areas where the bosque currently exists.

Construction of dams at Jemez Canyon (1953), Abiquiu (1963), Galisteo Creek (1970), and Cochiti (1973) were expected to slow aggradation or reverse the trend and promote degradation in the Middle Rio Grande Valley. The flood control improvements have reduced the sediment load in the Middle Rio Grande and accomplished flood control objectives for much of the river valley. This has caused changes in the geomorphology of the Rio Grande through the Albuquerque reach and affected the conveyance capacity of the active river channel. The result of these changes has been a reduction in the frequency of over-banking flows into the Rio Grande Bosque.

Within the Project Study Area, the Rio Grande is predominantly a sand bed river with low, sandy banks. There are numerous sandbars, and the river channel tends to be straight due to jetty jack fields and levee placement (Crawford *et al.* 1993). In this area, the river is typified by a uniform channel width averaging approximately 600 feet. Approximately two feet of degradation has occurred in the Albuquerque reach (due to flood control measures upstream) with no significant change in bed material (Mussetter 2006). The slope of the riverbed is less than 0.01 feet per foot (Tashjian 1999). At flows less than the bankfull, the river is establishing a sinuous configuration within the cleared floodway.

The riverbed is changing from one of fine silt particles and sand to coarse sands and gravel. This is a result of the fine sediments becoming trapped by upstream dams and removed in downstream reaches by hungry water. Over time, it is expected that the transitional area will continue to move downstream, accelerating the channel degradation process.

Hydrology

The hydrology of the Middle Rio Grande has been well documented. There are numerous reports that provide a good summary of the data collected. Among these reports are the MRGBBMP and Bio-Park Project (USACE 2003a). These two reports provide the basis for most of the text within this section.

The hydrology of the Middle Rio Grande valley has historically followed a pattern of high flows during spring snow melt runoff and low flows during the fall and winter months and short duration high flows from summer precipitation events.

Although considered a perennial river prone to major floods, there are reaches of the Middle Rio Grande that currently experience no surface flow during some summer months in dry climatic periods. It is likely that in certain dry years, this was the case prior to man's settlement of the area as well.

Construction of reservoirs, jetty jack fields, and levees for flood control was initiated beginning in the early 1900s. The Middle Rio Grande hydrology has been altered dramatically by the flood control facilities. Average yearly hydrographs for pre- and post-Cochiti Dam periods shows that Cochiti Dam has reduced the peak flows and extended the duration of the high-flow period. In addition, average winter base flows are somewhat larger during the post-dam period.

The actual flood flow capacity of the Rio Grande is determined by the location, size, and strength of the levee system and natural features such as terraces, mesas, and rock outcrops. Within the Middle Rio Grande, the reach through Albuquerque has the highest flood flow capacity: 20,000 cfs for sustained (spring) flows and 42,000 cfs for short duration (summer) flows. At the other extreme is the reach in the Corrales area on the east side, and between Albuquerque and Isleta on both sides of the river. In these areas the flood flow capacity is generally only 7,500 cfs (USACE 1989). Recently completed work on the Corrales levee may have increased this capacity.

Water Quantity

It is estimated that the average annual water loss due to Evapotranspiration (ET) in the Middle Rio Grande riparian corridor accounts for 20-50 percent of that reach's total water depletion (Dahm *et al.* 2002). Bosque ET appears to be higher in dense stands of salt cedar and in mature stands of cottonwood containing an extensive understory of salt cedar and Russian olive than it is in less dense salt cedar stands and mature cottonwood stands with few understory trees (Dahm *et al.* 2002). The Project Study Area contains large areas that are predominately tall trees with a relatively dense understory of saplings and shrubs and open stands of mid-sized tress with widely scattered shrubs and sparse herbaceous growth, although most of the understory is composed of salt cedar (USACE 2008). It has been estimated that ET in the densest portions of the Project Study Area equals approximately 562.6 acre-feet annually (USACE 2008).

Water Quality

Water quality in the Rio Grande through the Project Study Area is impacted by fecal coliform contamination, municipal point sources, urban runoff, and storm sewers (NMED Surface Water Quality Bureau 2002). There are three major storm sewer outfalls to the Rio Grande in the Project Area. Two of these outfalls are located on the east side of the river between the Bridge Boulevard and Central Avenue crossings. The third outfall is located near the old Atrisco Diversion on the west side of the river between the Central Avenue and I-40 crossings. Contaminants introduced to the Rio Grande from these outfalls include solid waste, oils, pesticide and herbicide residues, phosphorous, nitrogen, and fecal coliform (Tague and Drypolcher, 1979).

Vegetation Changes

A major change in vegetation dynamics in the bosque ecosystem has been loss of meander cut-off, meander migration, and flood scour processes, which were a driving force in the dynamics of the naturally functioning system. These processes removed existing vegetation and created new sites for founding of plant communities. Sediment deposition in the Project Area is now restricted to a few, largely ephemeral, mid-channel bars and transitory lateral bars proximal to the river. Meander cut-off and lateral meander migration no longer occur. Bare soil sites are now created primarily through mechanical disturbance or fire; typically in areas no longer subject to periodic inundation and with relatively dry soil moisture regimes (Pittenger 2003).

Non-native plant species have become prominent in the bosque. Salt cedar (*Tamarix ramosissima*) is now a prominent colonizer of exposed, bare soil sites in the bosque (Smith *et al.* 2002). Salt cedar produces seed for several months beginning in spring whereas cottonwood (*Populus deltoides wislizenii*) produces seed only for a short time in the spring, which remains viable for only about month and a half under ideal conditions (Ware and Penfound 1949, Horton *et al.* 1960). The flowering and fruiting phenology of salt cedar allows seedlings to establish on and dominate open sites wetted by runoff, rainfall, or river flows during the summer, precluding the possibility of cottonwood establishment on potentially suitable sites the following spring.

Fire was virtually unknown in naturally functioning, low-elevation riparian ecosystems of the Southwest (Busch and Smith 1993, Steuver 1997). However, fuel accumulations coupled with mainly human-caused ignitions have introduced fire as a major disturbance mechanism in the bosque ecosystem (Steuver 1997). Russian olive was present in the bosque in 1981 (Hink and Ohmart 1984) and continues to increase in the understory of the cottonwoods in the Project Study Area (Sivinski *et al.* 1990).

Several other non-native tree species, in addition to salt cedar and Russian olive, are at least locally common, if not abundant. These species are Siberian elm, tree of heaven (*Ailanthus altissima*), and mulberry (*Morus alba*). All three species are shade-tolerant and readily colonize disturbed sites (Crawford *et al.* 199, Sivinski *et al.* 1990).

Jurisdictional wetlands were found at six locations in the Project Study Area. These wetlands were characterized by shallow depth to water, saturated soils near the surface, organic-streaked sandy soils below about 10 inches, and vegetation dominated by coyote willow, cottonwood, inland saltgrass (*Distichlis spicata*), and Russian olive.

Water management, including development of impoundments, levees, and diversions have drastically altered natural hydrological processes (e.g., spring and monsoonal runoff). This altered hydrology limits natural regeneration of native cottonwoods and willows, and promotes the growth of non-native salt cedar and Russian olive, which are replacing the native

cottonwood/willow vegetative complex. As a result of these changes, the quality and quantity of fish and wildlife habitat has steadily decreased (USFWS 2001).

A listing of common and scientific names of plants that may occur in the Middle Rio Grande floodplain is provided in Appendix A.

Fish and Wildlife Changes

The uniqueness of the Rio Grande system and its critical value as wildlife habitat make it of the utmost significance as a resource. The bosque is unique; it is a thin line of significant riparian habitat in an arid landscape of the Southwest. The habitat quality, although diminished over the past few decades, still remains one of the most significant in the region. Over 300 species of birds, mammals, amphibians and reptiles live in the bosque, which are more than double those found in any other major ecosystem in the State. In addition to the indigenous wildlife species, the bosque serves as a migration route for thousands of North American birds moving along the Central Flyway.

The change from a mosaic of native plant communities of various structures and ages to increasingly large stands of non-native forest has affected the overall value of aquatic and terrestrial wildlife habitat provided by the bosque. There is an opportunity to rehabilitate the existing bosque into a dynamic mosaic of native vegetation patches of various ages, structure types and constituent species.

An estimated 407 species of vertebrates may occur in aquatic, wetland, or riparian habitat in Bernalillo County, based on a query of the Biota Information System of New Mexico (version 1/00). This estimate includes 24 species of fish, 11 amphibian taxa, 39 species of reptiles, 279 species of birds, and 54 mammalian taxa (Pittenger 2003). Birds are the most important group, based on number of taxa, comprising 69 percent of all vertebrate species in the estimate.

Terrestrial wildlife that were extirpated from the Rio Grande drainage included the gray wolf, jaguar, grizzly bear, river otter, and mink (Hink and Ohmart 1984). Approximately 46 mammalian species currently occur within the Middle Rio Grande (see Appendix B for a listing of common and scientific names of mammals).

Declining species are associated with decreasing native riparian areas, and the increasing species are associated with agricultural areas (Thompson *et al.* 1994). Therefore, changes in the fish and wildlife community of the Rio Grande are largely due to the direct and indirect effects of human settlements and/or development and manipulation of the Rio Grande and associated changes in watershed and riparian zones.

Aquatic Resources

Historically, 27 native fish species occupied the Rio Grande drainage (Sublette *et al.* 1990). Many native fish are extinct or extirpated from the Rio Grande in New Mexico. There are at least 31 introduced or non-native fish species within the Rio Grande drainage (Sublette *et al.* 1990). A considerable number of non-native fishes have been introduced into the Middle Rio Grande, either accidentally or as game fish by the New Mexico Department of Game and Fish. See Appendix C for a listing of common and scientific names of fish that may occur in the Middle Rio Grande.

The aquatic habitat in the Rio Grande has been altered by levees, dams, irrigation structures, and reservoirs for agriculture, flood control, recreation, and protection for developments within the floodplain. Jetty jack fields have straightened and channelized the river for more effective water transport. Reservoir operations have altered the river's natural hydrograph (i.e., its characteristic rise and fall) including reductions in peak spring flows (Crawford *et al.* 1993). Downstream of Cochiti Dam, the altered sediment and flow regimes have transformed the river from a wide, braided, sand bed system to a narrower and deeper channel with no active floodplain (U.S. Bureau of Reclamation 1999). Therefore, wetlands and slack water areas are scarce (Crawford *et al.* 1993). The cold, clear water releases from Cochiti Dam and the entrenched channel, armored with a gravel bed, have created an aquatic system that favors cool-water fishes and invertebrates, and limits warm-water fisheries below the dam downstream to Albuquerque. Consequently, the existing aquatic resources in the Project Study Area differ from those that occurred historically due to human activities (Crawford *et al.* 1993). The loss of native fish species in the Middle Rio Grande illustrates that the hydrologic and morphological changes in the channel have had a major impact on fishery resources. The Rio Grande silvery minnow (minnow) (*Hybognathus amarus*) is the only native pelagic, broadcast spawning minnow surviving in the Middle Rio Grande (Bestgen and Platania 1991).

Terrestrial Resources

Vegetation

The change from a mosaic of native plant communities of various structures and ages to increasingly large stands of non-native forest has affected the overall value of aquatic and terrestrial wildlife habitat provided by the bosque. There is an opportunity to rehabilitate the existing bosque into a dynamic mosaic of native vegetation patches of various ages, structure types and constituent species.

The degradation of the bosque ecosystem has impaired interpretive, educational and recreational uses of the bosque in one of the most heavily used segments of the RGVSP. There is an opportunity to develop existing trails into a highly educational, aesthetically pleasing and safe interpretive system that furthers the overall goal of restoration.

The loss of wetlands, braided channels and backwaters has reduced the extent and quality of aquatic habitat and the potential for aquifer recharge. There is an opportunity to restore and create new wet habitat, which would improve habitat and recharge potential, as well as provide storm water filtration.

The lack of inundation, scouring and sediment deposition within the bosque has curtailed native tree species such as cottonwood and willow seedling recruitment, increased the mortality rate of cottonwoods and willows, and resulted in significant leaf litter and dead and down wood, as well as a skewed age structure in the remaining cottonwood stands. There is an opportunity to remove dead and down wood and create new areas for colonization or planting of native vegetation.

Human uses in the bosque connected to urbanization in areas outside the levees have further degraded the bosque through widespread dumping, accidental fires and high-impact recreational uses. There is an opportunity to clean up and revegetate these sites, as well as limit access and structure human use and experience of the bosque through well-developed trails and interpretive signage.

The cumulative impact of the loss of inundation, the lower water table, cottonwood mortality and urbanization has led to the replacement of the mosaic of native woodlands and wetlands in many parts of the Study Area by dense stands of non-native salt cedar, Russian olive, Siberian elm, tree of heaven and white mulberry trees. There is an opportunity to remove non-native plants and revegetate with a variety of native plants, thereby improving habitat.

The strings of jetty jacks and altered vegetation structure of the bosque have increased the potential for a catastrophic fire in the bosque. The density of the brush and existing jetty jacks can also make fighting a fire difficult and potentially dangerous. An opportunity exists to remove some of the jetty jacks and much of the vegetation that has created the existing fire hazard.

The past water management operations and flood control measures, including levees, jetty jacks and upstream dams, have eliminated the historic broad, meandering channel and the flood regime that had resulted in periodic inundation of the bosque. Even with these limitations, however, there is an opportunity to re-create some limited hydraulic connectivity between the bosque and the river by enhancing existing high-flow side channels, excavating swales, constructing wet habitat and other interventions.

Mammals

Existing mammal populations are also a result of the existing water operations and land uses in the Project Study Area. Hink and Ohmart (1984) performed systematic floral and faunal surveys throughout the Middle Rio Grande. Residential development, agricultural conversion and subsequent irrigation systems, and construction of bridges/roads resulted in the permanent loss of all habitats within developed areas. Development has also caused a disruption of animal

movement and dispersal patterns, and has caused continual disturbance to animal communities in the adjacent, fragmented portions of the bosque (Crawford *et al.* 1993). Residential development, agricultural conversion and subsequent irrigation systems, and construction of bridges and roads resulted in permanent loss of all habitats in the developed area, disruption of animal movement and dispersal, and creation of a continual disturbance that affects animal communities in the adjacent fragmented portions of the bosque (Crawford *et al.* 1993). The largest mammals likely to occur in the Project Area are black bear, mule deer, and coyotes. Other mammals such as raccoon, beaver, muskrat, long-tailed weasel, and striped skunk may occur in the general Project Study Area. Desert cottontail rabbit, black-tailed jackrabbit, rock squirrel, pocket gopher, deer mouse, western harvest mouse, and American porcupine are also likely to occur. The most common small mammals in the Middle Rio Grande bosque are the white-footed mouse and house mouse (Stuart and Bogan 1996). Eleven species of bats are found along the Rio Grande (Findley *et al.* 1975). Two bat species are restricted to riparian areas, the Yuma myotis and little brown bat.

Opportunities exist to increase in the amount of moist, densely-vegetated habitats and coyote willow stands would also likely increase the abundance of small mammals. The amount of habitat for mammal species associated with wetlands in the bosque would increase.

Birds

Hink and Ohmart (1984) found that riparian areas are used heavily by most bird species in New Mexico. Cottonwood-dominated community types are used by large numbers of bird species, and are preferred habitat for a large proportion of the species, especially during breeding season. Bird density appears to be strongly related to density of foliage, regardless of species composition of the plant community. In the Hink and Ohmart study, bird densities were higher in stands of non-native trees and shrubs. Marshes, drains, and areas of open water contribute to the bird diversity of the riparian ecosystem because of the strong attraction by water-loving birds. At various times of the year, such as during migration, riparian areas support the highest bird densities and species richness in the Middle Rio Grande region.

The river in and near the proposed Project Study Area provides habitat on a seasonal basis for a variety of waterfowl including Canada geese, mallard, gadwall, green-winged teal, American widgeon, northern pintail, northern shoveler, ruddy duck, and common merganser. Shorebirds such as the spotted sandpiper and killdeer may occur in the Project Area. Raptors that may occur in the Project Area include the bald eagle, turkey vulture, northern harrier, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, American kestrel, common barn owl, and great-horned owl. Game species include the mourning dove and scaled quail.

Opportunities exist to increase in the amount of moist, densely-vegetated habitats and coyote willow stands would also likely increase the abundance of birds. The amount of habitat for avian species associated with wetlands in the bosque would increase.

A listing of common and scientific names of birds that may occur in the Middle Rio Grande floodplain is provided in Appendix D.

Reptiles and Amphibians

Hink and Ohmart (1984) documented 3 turtle species, 17 lizard species, and 18 snake species in the Middle Rio Grande Valley. Many of these are upland species that do not occur regularly in the riparian habitats. Riparian and upland habitats in the Project Study Area likely support a diverse assemblage of reptiles and amphibians. According to Degenhardt *et al.* (1996), up to 57 species of reptiles may occur in the Middle Rio Grande of New Mexico. Most amphibians depend on the aquatic habitat of riparian areas for at lease a portion of their lifecycle, which are generally lacking in the Project Study Area.

Opportunities exist to increase in the amount of moist, densely-vegetated habitats and coyote willow stands would also likely increase the abundance of reptiles and amphibians. The amount of habitat for reptiles and amphibians species associated with wetlands in the bosque would increase.

A listing of common and scientific names of reptiles and amphibians that may occur in the Middle Rio Grande floodplain is provided in Appendix E.

Threatened and Endangered Species

As the quality and quantity of the fish and wildlife habitat within the Middle Rio Grande corridor has decreased so has its ability to sustain certain native flora and fauna. Several species endemic to the Middle Rio Grande are extinct, extirpated, or have been federally listed as threatened or endangered under the Endangered Species Act (ESA). This CAR provides information concerning the federally listed endangered Rio Grande silvery minnow with designated critical habitat and the endangered southwestern willow flycatcher that may be affected by the proposed project.

Rio Grande Silvery Minnow

The minnow was formerly one of the most widespread and abundant species in the Rio Grande Basin occurring from Española, New Mexico, to the Gulf of Mexico (Bestgen and Platania 1991). The silvery minnow currently occupies a 170-mile reach of the Middle Rio Grande, New Mexico, from Cochiti Dam, Sandoval County, to the headwaters of Elephant Butte Reservoir, Socorro County (USFWS 1994). Currently is the only remaining endemic pelagic spawning minnow in the Middle Rio Grande.

The species was federally listed as endangered in July 1994 (59 FR: 36988-37001) and is also listed as endangered by the State of New Mexico. The Service (58 FR: 11821-11828) cited the

de-watering of portions of the Rio Grande below Cochiti Dam through water regulation activities, the construction of main-stream dams, the introduction of non-native competitor/predator species, and the degradation of water quality as factors responsible for declines in the minnow population. On February 19, 2003, the Service published a final rule establishing critical habitat for the minnow within the last remaining portion of their historical range in the Middle Rio Grande, from Cochiti Dam to the utility line crossing the Rio Grande, a permanent identified landmark in Socorro County (68 FR: 8088-8135). Portions of the proposed project occur within designated minnow critical habitat.

Within the Project Study Area, past actions have eliminated and severely altered habitat conditions for the minnow. Narrowing and channel deepening, restraints to channel migration through jetty jacks, the invasion of non-native vegetation species, and changes in the flow regime have all adversely affected the minnow and its habitat. These environmental changes have degraded spawning, nursery, feeding, resting, and refugia areas required for species survival and recovery (USFWS 1993).

Natural habitat for the minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by minnows (Sublette *et al.* 1990, Bestgen and Platania 1991).

The proposed project would provide opportunities to increase potential habitat for the minnow and create additional nursery habitat in this reach. If successful, these construction activities would help the minnow population and its critical habitat.

This project would create additional habitat that would potentially benefit the minnow. The proposed project would create management solutions that may partially fulfill requirements of the "Biological and Conference Opinions on the Effects of Actions Associated with the Programmatic Biological Assessment of the Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico," for the minnow and its critical habitat.

Comment [I1]: And it's critical habitat?

Southwestern Willow Flycatcher

The Service listed the southwestern willow flycatcher (flycatcher) (*Empidonax traillii extimus)* as endangered on February 27, 1995 (60 FR: 10694-10715). The flycatcher is also classified as endangered by the State of New Mexico (New Mexico Department of Game and Fish 1987). In New Mexico, the species has been observed in the Rio Grande, Rio Chama, Zuni, San Juan, San Francisco, and Gila River drainages. Available habitat and overall numbers have declined statewide (62 FR: 39129-39147). A final recovery plan for the flycatcher has been developed (68 FR: 10485).

Loss and modification of nesting habitat is the primary threat to this species (Phillips *et al.* 1964, Unitt 1987, 58 FR: 39495-39522). Loss of migratory stopover habitat also threatens the flycatcher's survival. Large scale losses of Southwestern wetlands have occurred, particularly the cottonwood-willow riparian habitats that are used by the flycatcher (Phillips *et al.* 1964, Carothers 1977, Rea 1983, Johnson and Haight 1984, Howe and Knopf 1991).

The flycatcher is a riparian obligate and nests in riparian thickets associated with streams and other wetlands where dense growths of willow, buttonbush, boxelder, Russian olive, salt cedar or other plants are present. Nests are often associated with an overstory of scattered cottonwood. Throughout the flycatcher's range, these riparian habitats are now rare, widely separated by vast expanses of arid lands, in small and/or linear patches.

Flycatchers begin arriving in New Mexico in late April and May to nest, and the young fledge in early summer. Flycatchers nest in thickets of trees and shrubs with a densely vegetated understory from the ground or water surface. Surface water or saturated soil is usually present beneath or next to occupied thickets (Phillips *et al.* 1964, Muiznieks *et al.* 1994). At some nest sites, surface water may be present early in the nesting season with only damp soil present by late June or early July (Muiznieks *et al.* 1994, Sferra *et al.* 1995). Habitats not selected for nesting or singing are narrower riparian zones with greater distances between willow patches and individual willow plants. Suitable habitat adjacent to high gradient streams does not appear to be used for nesting. Areas not selected for nesting or singing may still be used during migration.

Potential flycatcher habitat exists along the Rio Grande in the Albuquerque area. This habitat is primarily composed of riparian shrubs and trees, chiefly Goodding's, peachleaf, and coyote willow, Rio Grande cottonwood, and salt cedar. The habitat within the Project Study Area may be used by migrating flycatchers.

This project would create additional habitat that would potentially benefit the flycatcher. The proposed project would create management solutions that may partially fulfill requirements of the "Biological and Conference Opinions on the Effects of Actions Associated with the Programmatic Biological Assessment of the Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico," for the flycatcher and its potential habitat.

Comment [I2]: And it's potential habitat?

PROJECT DESCRIPTION

Development of the Route 66 Project follows the USACE six-step planning process specified in Engineering Regulation (ER) 1105-2-100. These steps include 1) identifying problems and opportunities, 2) inventorying and forecasting conditions, 3) formulating alternative plans, 4) evaluating alternative plans, 5) comparing alternative plans, and 6) selecting a plan. This process is used to identify and respond to problems and opportunities associated with the Federal objective and specific state and local stakeholder concerns.

As part of identifying the Preferred Alternative, a number of alternative plans were developed by the Project Delivery Team and compared with the "no action alternative," allowing for the ultimate identification of the Recommended Plan or National Ecosystem Restoration (NER) Plan. The NER Plan reasonably maximizes ecosystem restoration benefits compared to costs, considering the cost-effectiveness and incremental cost of implementing other restoration options.

Comparison of Selected Alternatives

A number of alternatives were considered and rejected, including: 1) the No Action Alternative; 2) All Features Alternative; 3) Removal Features Only Alternative; 4) Significant Recreational and Interpretive Features Alternatives; 5) Other Cost-Effective Alternatives; 6) Best Buy Plans 2, 3, and 4 Alternatives; 7) Best Buy Plan 6 Alternative; and the 8) Preferred Alternative.

No Action Alternative

Future conditions without project implementation were projected to characterize the No Action Alternative and its effects, and to form a basis for comparison of restoration benefits. Throughout the Middle Rio Grande Valley, the river, floodplain, and the associated fish and wildlife populations would be expected to continue to experience adverse effects from new and ongoing Federal, state, and private water resource development projects. Additionally, increasing urbanization and development within the historic floodplain would continue to eliminate remnant riparian areas located outside the levees, putting increased pressure on the habitat and wildlife in the riparian zone within the floodway. Local agencies would continue to perform maintenance of non-native vegetation as they are able, but the features connecting the bosque and river would not be constructed.

All Features Alternative

An "All Features Alternative" was briefly considered, but rejected for budgetary reasons. The cap on the budget for 1135 projects is just under $7 million. Since the All Features Alternative would cost more than the cap set by legislative authority, and the incremental increase in habitat units was minor, it was rejected. All Features Alternatives by class or type of feature, (e.g., all water related features, all bosque features) were also considered singly, but rejected because by focusing on only one habitat type, they would not satisfy the goal of creating a dynamic mosaic in the bosque.

Removal Features Only Alternative

Although not generated by the Incremental Cost Analysis, a Removal Only Alternative was considered. This alternative would consist of all of the Removal Features, (i.e., the removal of all non-native vegetation, dead and down wood, dumps and debris and jetty jacks) in the Project

Area. This alternative is consistent with the project goals of improving the health of the native bosque and reducing the fire hazard. Under this alternative, however, there would be no re-vegetation other than seeding in areas of major disturbance from the removal process. The Removal Only Alternative would enable native plants to have a better opportunity to succeed in the bosque, but no new habitat would actually be created directly by this alternative in the near term. There would be little possibility of re-establishing the dynamic mosaic in the bosque. No additional wet habitat or other water-related features would be created. Woodland, savannah and open areas would predominate, and there would be few, if any, bosque patches with the understory that are crucial to wildlife diversity in the bosque (Pittenger 2003; Hink and Ohmart 1984). Under this alternative, no additional recreational elements would be created, which is inconsistent with the current intensity of recreational use of the Project Study Area. For these reasons and for the reason that the USACE Bosque Wildfire Project and OSD's fuel reduction efforts may complete much of the removal process, this alternative was rejected.

Significant Recreational and Interpretive Features Alternatives

Alternatives that contained more intensive recreational features such as paved trails, pavilions, restrooms, picnic areas, etc., within the solution areas were considered. However, this would increase the amount of human disturbance in the Project Study Area. The Route 66 Project's primary goal was to restore the bosque and the wildlife habitat it provides by channeling recreational use to fewer, designated areas, thereby reducing the impact of recreational users elsewhere in the bosque. Furthermore, although this portion of the bosque sustains the greatest amount of recreational use, it does not warrant greater expenditures than that typically allocated for Section 1135 projects at the expense of restoration features. USACE Policy Guidance Letter No. 59, "Recreation Development at Ecosystem Restoration Projects" limits recreational features to ten percent of project costs, unless prior approval from the Assistant Secretary of the Army (Civil Works) is obtained. The guidance further indicates that this limit "…. should be viewed as an upper limit on Federal cost sharing and not as a goal for expenditures." Therefore, alternatives that included significant recreational and interpretive features were also rejected.

Other Cost-Effective Alternatives

Other cost-effective plans generated by the Incremental Cost Analysis were eliminated as alternatives in favor of the Best Buy Plans. In addition, a number of the Solution Areas not selected as part of one of the Best Buy Plans have significant existing habitat and/or are likely to be the focus of restoration activities as part of the other projects being undertaken in the Albuquerque reach by USACE. For example, Solution Areas G and I are included in the Bio-Park Project's created wetlands. Solution Areas A, B and C would be addressed as part of the Bosque Wildfire Project.

Best Buy Plans 2, 3, and 4 Alternatives

Best Buy Plans 2, 3 and 4 Alternatives were also evaluated. All three of these alternatives were composed of various mixes of habitat. Best Buy Plans 2, 3 and 4 Alternatives were rejected primarily because the target goal percentage for shrub thicket habitat was not met and the total acreage of bosque patch habitat would have exceeded 50 percent. Although all of the Best Buy Plans (other than the No Action alternative) had larger percentages of wet habitat, the skewed distribution toward bosque patch habitat was counter to the overall goal of the proposed project to restore the dynamic mosaic of the bosque.

Best Buy Plan 6 Alternative

The primary difference between the Best Buy Plan 6 Alternative and the Preferred Plan was the inclusion of Solution Area A. This alternative has perhaps the best overall distribution of habitat. Although Best Buy Plan 6 Alternative meets the target percentages, the incremental cost is greater than Best Buy Plan 5. For this reason and because the cost of implementing this plan, given other costs would have exceeded the budget, Best Buy Plan 6 Alternative was rejected. Additionally, the inclusion of Solution Area A would have eliminated the possibility of including interpretive and recreational features in the project, which are important to the sponsor. As stated previously, the Project Area is one of the most intensively used areas in the bosque, and there is opportunity through the proposed recreational features to: 1) lessen the potential impact of recreation on the bosque in the Project Area; and 2) to provide connections to a number of recreational amenities in adjacent areas which can support more active uses.

Preferred Alternative

The Preferred Alternative is Best Buy Plan 5 combined with the proposed interpretive and recreational facilities. Best Buy Plan 5 meets the target percentages and even exceeds the overall target percentages for the three different habitat types, and through implementation would result in a dynamic mosaic in the Project Area. Implementation of Best Buy Plan 5 would result in the restored bosque and allows for all of the objectives of the proposed project to be met. The overall budget for Best Buy Plan 5 would allow for much needed designated recreational and interpretive features which would reduce the overall impact of recreational users on the bosque as it is restored while still providing important connections to adjacent facilities. Implementation of the Preferred Alternative would maintain and enhance the function of the bosque in the Project Area as a wildlife refuge and integrate it into the fabric of the COA's portion of the Middle Rio Grande bosque.

IMPACTS OF PREFERRED ALTERNATIVE

Implementation of the Preferred Alternative should improve habitat in the bosque and benefit fish and wildlife resources. The Preferred Alternative would include removal of jetty jacks and non-native vegetation across 121 acres of bosque north and south of Central on the west side of

the river and north of Central on the east side of the river, Non-native vegetation to be removed would include salt cedar (*Tamarix ramosissima*), Russian olive (*Elaeagnus angustifolia*), Tree of Heaven (*Ailanthus altissima*) and Siberian elm (*Ulmus pumila*). The proposed action also includes recreating 3 hi-flo channels, and enhancing 1 outfall wetland at the Gonzales Drain. Further restoration features include planting of native vegetation throughout the project area (121 acres) and creation of a number of willow swales. Improvements of existing facilities for educational, interpretive and low-impact recreational uses are also included in the Preferred Alternative. Trail and facility improvements would help minimize impacts to fish and wildlife habitats by directing recreational use to designated areas. The fire breaks proposed under the Preferred Alternative should reduce the risk of catastrophic bosque fire and its impacts to fish and wildlife resources.

EVALUATION METHODOLOGY

Since project planning began in 2002, the Service has attended meetings with the USACE, MRGCD, and the COA to discuss project features, design, and construction methods. The Service and USACE also conducted a joint field trip to the Project Area. Additional biological data and background information were derived through review of relevant literature and personal communications. The USACE and the COA have provided a majority of the technical and background information. Surveys for the southwestern willow flycatcher were conducted in the project vicinity, but no flycatchers were detected within the Preferred Alternative area. Minnow surveys were conducted in the Rio Grande along the Albuquerque reach in previous years.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The river, floodplain, and the associated fish and wildlife would continue to experience adverse effects from Federal, state, and private actions, including new and long-term ongoing activities. In addition, increasing urbanization and development within the historic floodplain would continue to eliminate remnant riparian areas located outside the levees, while putting increased pressure on the habitat and wildlife in the riparian zone.

Channelization, levee replacement and construction, Kellner jetty jack installation and maintenance, sediment retention in reservoirs, and channel widening would continue to have effects on patterns of erosion, aggradation, and maintenance or regeneration of riparian vegetation. These river management structures created a fixed channel plan form and a narrower floodplain that has less frequent inundation. The result has been disruption or termination of major processes of dynamics in a naturally functioning bosque ecosystem.

The bosque would remain as is or continue to deteriorate without the project. Jetty jacks would continue to confine the Rio Grande to its existing channel, causing the river in the Project Area to further incise. As the river channel further incises, the water table would continue to lower. Periodic bosque flooding would become increasingly uncommon or nonexistent. Recruitment of native vegetation would decline as the water table lowers, bosque flooding diminishes, and non-

native vegetation proliferates. Thus, non-native vegetation in the bosque would increase in abundance while native vegetation would decrease. Vegetative water demand and evapotranspiration would likely increase as non-native vegetation proliferates. This may exacerbate the rate at which the water table declines. Bosque wetland habitat would further degrade and/or be lost as the water table lowers and non-native vegetation invades. As non-native vegetation accumulates, the risk of catastrophic bosque fire would increase. Human induced fires and high impact recreation in the Project Area would also continue to occur without the project.

Without implementation of the Preferred Alternative additional substantial enhancement of native riparian vegetation and wet habitat in the Project Area, with concurrent reduction of nonnative stands would not occur. The overall quality and quantity of fish and wildlife habitat is expected to continue to deteriorate within the Project Area.

Vegetation structure and species composition in the Project Area would not alter about 121 acres. Clearing of non-native understory vegetation and woody debris as part of a fire-fuel reduction program conducted under the Bosque Wildfire Project would continue. The combined effect of proposed Non-native Plant Removal, Planting of Native Species, and Excavation of Channel, Outfall Channel, and Swale areas on vegetation structure dominated by non-native species would be minimized. With respect to the entire Project Area, without implementation of the Preferred Alternative the overall increase in the diversity of vegetation communities would no occur.

Without maintenance of the Project Area the establishment of non-native-dominated stands would continue. The High-Flow Channels and Swales would not likely result in propagation of native vegetation. During times of low flow, the channels would not provide a moist soil area for plants, such as coyote willow, sedges, and rushes, and wildlife that prefer moister environments. Both functions are critical to improving the overall habitat in the reach (Crawford *et al.* 1993).

The High Flow channel features may not restore some semblance of over-bank flooding in localized areas. Thus establishment of early successional stands dominated by cottonwood and coyote willow would not occur. Localized lowering of the soil surface in Swales would not occur therefore some areas would not restore naturally functioning wetland plant communities in those areas. Fluvial geomorphic processes that create new sites for establishment of early succession wetland and shrub-sapling communities (Pittenger 2003) would not be influenced by the Preferred Alternative.

Individual locations within the proposed project would not have varied re-vegetation strategies. Edge effect and the creation of denser patches such as the proposed shrub thickets important for increasing wildlife diversity within the bosque would not occur. The long-term effects of replacing the non-native dominated vegetation system with native dominated species would not be as extensive.

Without the implementation of the Preferred Alternative, creation of wet habitat would not increase habitat available for wetland-dependent reptile and amphibian species. The expected increase in the amount of moist, densely-vegetated habitats and coyote willow stands would not occur therefore, an increase small mammal habitats and abundance would not be likely. The amount of habitat for mammal species associated with wetlands in the bosque would not increase.

While bird species richness may not increase in the Project Area as a result of the Preferred Alternative, bird abundance and the amount of habitat suitable for rare bird species would likely remain the same. Without restoration of wetlands, cottonwood-willow, and cottonwood-New Mexico olive habitats, Neotropical migrant bird species that breed in the bosque would likely remain at current levels. Without restoration of early-successional willow thickets, in association with wetlands increase the amount of suitable habitat for the flycatcher and other bird species associated with wetlands and riparian shrub habitat would not occur. The proposed work would occur during the winter therefore disturbance to Bald Eagles and other wintering birds may occur. The peak nesting season in the bosque is April through August without the proposed project effects to breeding birds would be minimal.

Trails and recreational developments would not occur without implementation of the Preferred Alternative and could have a negative impact on bird abundance and species richness in the Project Area. Approximately 40,000 linear feet of undesignated trails would not be replaced by approximately 13,900 linear feet of stabilized trails and 8,600 linear feet of soft-surface trails. Human presence and disturbance in the bosque reduces habitat quality for many bird species and in general results in lower species richness and bird abundance (Thompson *et al.* 1994). Recreational uses of trails by hikers, bicyclists, and equestrians cause noise disturbance and usually results in waste accumulation (which may attract scavengers and predators) would continue. Additionally, trails create openings that may facilitate brown-headed cowbird parasitism. The frequency and intensity of recreational use associated with the proposed recreation features may further reduce habitat suitability for birds in the Project Area.

The primary goal and effect of implementation of the Preferred Alternative is to revegetate with native species, which would create a healthier ecosystem in the long-term for native wildlife. Without implementation of the Preferred Alternative short-term negative affects on fish and wildlife with long-term positive benefits would not occur.

Threatened and Endangered Species

Foreseeable affects to the minnow its critical habitat and to the flycatcher are discussed below. A Biological Assessment has been submitted to the USFWS for their concurrence on these species.

Rio Grande Silvery Minnow

The proposed work for habitat enhancement within designated critical habitat for the minnow would not be conducted. Construction from the proposed project and other projects within the Project Area would not take place in the channel but it would take place along the bank and it may result in erosion or other inputs into the river. The proposed project would provide potential habitat for the minnow and could potentially create additional nursery habitat in this reach which would help the minnow population.

Southwestern Willow Flycatcher

Flycatcher surveys would be conducted if other federal activities were proposed at the project locations. Surveys conducted in 2002 through 2005 have detected flycatchers within the Project Study Area but not in the proposed project action area. Critical habitat has been designated for the flycatcher but is not within the proposed Project Study Area therefore the proposed project would not affect it critical habitat. No breeding habitat has been identified during protocol surveys therefore it is highly unlikely that breeding habitat for the flycatcher would be affected. Other projects in the area, such as the Bio-Park Project, have created additional potential habitat for the flycatcher. Without this project, additional habitat that would potentially benefit the flycatcher would not be created.

Without the proposed project some of the management solutions in the Preferred Alternative that may partially fulfill requirements of the "Biological and Conference Opinions on the Effects of Actions Associated with the Programmatic Biological Assessment of the Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico," for both the minnow and the flycatcher would not be realized.

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

Temporary, short-term impacts to fish and wildlife may occur from noise, dust, and the presence of workers and machinery during project construction. Runoff from construction work sites, access routes, staging areas, and unprotected fills could degrade water quality in the Rio Grande. Accidental spills of fuels, lubricants, hydraulic fluids and other petrochemicals, although unlikely, would be harmful to aquatic life.

Implementation of the Route 66 Project should improve long-term bosque habitat conditions. Selected jetty jack removal should help facilitate meandering of the river and overbank flows in the Project Area. As fluvial processes in the river and bosque return to a state nearer to natural conditions, incision of the river channel should slow or cease. As a result, lowering of the water table in the Project Area should slow or cease. Overbank flows should promote native cottonwood and willow recruitment in the bosque. As native species proliferate, non-native species should, to some extent, be displaced or outcompeted. Overbank flows and flows through

the high-flow side channels should help reduce accumulated fuels. This should help reduce the likelihood of catastrophic bosque fires. Human impacts to the Project Area should also decline through implementation of the interpretive elements of the project. The proposed trail improvements should encourage people to stay in designated areas and minimize use in sensitive areas. This would help facilitate bosque habitat recovery, and minimize or prevent future human induced disturbances.

With the project, short- and long-term, bosque conditions are expected to improve. Species diversity should increase and future habitat conditions should help ensure the continued persistence of federally listed species and other fish and wildlife resources. Wetlands would be created and the quality of existing wetlands should improve. Native cottonwood and willow should begin to recover as non-native vegetation is reduced in the Project Area. The overall quality and quantity of fish and wildlife habitat is expected to improve.

According to Crawford *et al.* (1993), wetlands have experienced the greatest decline of any floodplain plant community within the Middle Rio Grande. The creation of additional wetland communities would help to reduce this trend. This project supports Crawford *et al.* (1993) Recommendation No. 15 (to protect, enhance, and create wetlands throughout the Middle Rio Grande riparian zone). The bosque wetlands would create more open water habitat and edge habitat, thus increasing benefits to fish and wildlife resources. The replacement of exotic species with native species would increase the amount and types of food and cover available for resident and migratory birds and thereby increase species diversity. Long-term bosque restoration and wetland creation would enrich the local fauna by attracting wildlife that otherwise are uncommon in the arid Southwest (Crawford *et al.* 1993).

The combined effect of proposed Non-native Plant Removal, Planting of Native Species, and Excavation of Channel, Outfall Channel, and Swale areas on vegetation structure dominated by non-native species would be changed to open areas or stands dominated by native species, namely cottonwood and coyote willow. With respect to the entire Project Study Area, the Preferred Alternative would result in an overall increase in the diversity of vegetation communities.

This forecast of future conditions assumes that maintenance of the Project Area would prevent reestablishment of non-native-dominated stands and that Outfall Channel Habitat, High-Flow Channels, and Swales would develop and maintain a hydrologic connection between the river and bosque. The High-Flow Channels and Swales would likely result in propagation of native vegetation, which would help the area. During times of low flow, the channels would provide a moist soil area for plants, such as coyote willow, sedges, and rushes, and wildlife that prefer moister environments. Both functions are critical to improving the overall habitat in the reach (Crawford *et al.* 1993). Over the long term, the cottonwood-dominated structure stands would develop into later successional structure types.

The High Flow channel features could potentially restore some over-bank flooding in localized areas. This could promote establishment of early succession stands dominated by cottonwood and coyote willow. Localized lowering of the soil surface in Swales could subject some areas to fluctuating moisture regimes, which could restore functioning wetland plant communities in those areas.

Individual locations within the proposed project would have varied re-vegetation strategies in order to achieve the target mosaic and stay within current water demands. Re-creation of the tiered bosque forest is important to sustaining a number of plants and animals in the bosque (Crawford *et al.* 1993, Hink and Ohmart 1984). These areas would become the patchy groves described in many of the early accounts of the river valley near Albuquerque (Scurlock 1998). The larger size of these patches would provide important core habitat, while maintenance of the firebreaks would provide important edge habitat (Hink and Ohmart 1984). Edge effect and the creation of denser patches such as the proposed shrub thickets would be important for increasing wildlife diversity within the bosque (Crawford *et al.* 1993, Hink and Ohmart 1984). Although, the Preferred Alternative may not be able to positively influence all the degradation processes at work in the bosque, replacement of dead material and non-native vegetation with a mosaic of native vegetation should lead to a system of less water use, decreased fire danger, and increased diversity of native species for use by wildlife. Therefore, the long-term effects of replacing the non-native dominated vegetation system with native dominated species is proposed to outweigh the short-term negative effects, which would be caused by the Preferred Alternative.

Creation of wet habitat in the Project Area would increase habitat available for wetland-dependent reptile and amphibian species. An increase in the amount of moist, densely-vegetated habitats and coyote willow stands would also likely increase the habitat and abundance of small mammals.

While bird species richness may not increase in the Project Study Area as a result of the Preferred Alternative, bird abundance and the amount of habitat suitable for rare bird species would likely be increased. Restoration of wetlands, cottonwood-willow, and cottonwood-New Mexico olive habitats would provide important habitat, particularly for Neotropical migrant bird species that breed in the bosque (Thompson *et al.* 1994). Many Neotropical migrant bird species in the western U.S. are declining and many of those species breed in riparian areas, which makes those habitats particularly important (Finch 1991). Restoration willow thickets, in association with wetlands, could increase the amount of suitable habitat for the flycatcher and other bird species associated with wetlands and riparian shrub habitat. Timber-foliage foraging, timber-drilling, and timber-gleaning species that nest in the bosque would be enhanced.

The emphasis in the Preferred Alternative on creating edge habitat and a fine-grained distribution of restoration features may facilitate brood parasitism by the brown-headed cowbird. This is a threat to many nesting bird species in the bosque, including the endangered flycatcher (Finch *et al.* 1995, Schweitzer *et al.* 1998). Clustering numerous small patches to create larger, contiguous habitats and reducing the number of edges adjacent to open areas where cowbirds forage could

potentially offset this effect. Also, increasing vegetation of open areas to reduce their coverage in the Project Area would reduce cowbird foraging habitat.

Trails and recreational developments that would occur with implementation of the Preferred Alternative could have a negative impact on bird abundance and species richness. Human presence and disturbance in the bosque reduces habitat quality for many bird species and in general results in lower species richness and bird abundance (Thompson *et al.* 1994). The Preferred Alternative includes about 22,500 linear feet of trails, benches, signs, two boardwalks, and wildlife blind. Recreational uses of trails by hikers, bicyclists, and equestrians causes noise disturbance and usually results in waste accumulation (which may attract scavengers and predators). Trails create openings that may facilitate brown-headed cowbird parasitism. The frequency and intensity of recreational use associated with the proposed recreation features may further reduce habitat suitability for birds. However, the design, construction and maintenance of a limited number of formal trails would be preferable to the existing condition where numerous informal trails have been created and are used.

The proposed work would occur during the winter, which is when Bald Eagles may be in or near the Study Area. In order to minimize the potential for disturbing Bald Eagles utilizing adjacent habitat, the following guidelines would be employed. Also, cottonwood snags or other large trees present along the riverbanks that may serve as potential roost habitat would be left intact as part of this project. Implementation of these measures would preserve undisturbed Bald Eagle use of roost, foraging and perching sites in the riparian area adjacent to the project sites.

The peak nesting season in the bosque is April through August. In order to minimize potential effects on nesting birds in the Project Area, clearing of live vegetation would only occur between September and April.

Since the primary goal and effect of implementation of the Preferred Alternative is to restore the bosque with native species, which would create a healthier ecosystem in the long-term for native wildlife, these short-term effects (displacement, etc.) and impacts of limited recreational access would be outweighed by the long-term benefits. Therefore, the Preferred Alternative would have short-term negative affects on fish and wildlife with long-term positive benefits.

Threatened and Endangered Species

Foreseeable effects to federally listed species are discussed below. A Biological Assessment has been submitted to the Service for their concurrence on these species. Analysis of effects to listed species will be addressed in detail during ESA section 7 consultation between the Corps and the Service.

Rio Grande Silvery Minnow

The proposed work area is within designated critical habitat for the minnow. Work would not take place in the channel but it would take place along the bank and it may result in erosion or

other inputs into the river. When work is to occur close to the bank of the river, best management practices (BMPs) would be enforced to prevent erosion inputs into the river. These BMPs would include, but would not be limited to: the use of silt fences without lead weights adjacent to the riverbank to prevent erosion to the river; blocking of work zones to the river when constructing the High-Flow Channels, fueling of vehicles would not take place inside the levees; and storage of equipment and vehicles should not occur in the bosque.

Additionally, this project would provide potential habitat for the minnow and would create additional nursery habitat in this reach which would help its distribution and abundance. The bosque wetlands would create more open water habitat and edge habitat, thus increasing benefits to fish and wildlife resources.

Southwestern Willow Flycatcher

Flycatcher surveys conducted in 2002 and 2003 did not find any nesting activity in the Project Study Area. During the 2004 and 2005 survey seasons, flycatchers were detected within the Project Study Area along the Tingley Bar. In 2004 a single individual was heard and observed singing in a clump of salt cedar along the river bank, and the second individual was heard singing in a dense clump of tall coyote willow on the river bar. In 2005, an individual was heard and observed in a stand of Russian olive on an island bar. It is presumed that these individuals were migrants.

Based on surveys it is highly unlikely that nesting flycatchers would occupy the Project Study Area during the construction. It is very possible that migrants would be detected, as they were along the Tingley Bar during the 2004 and 2005 survey periods.

Critical habitat has been designed for the flycatcher but is not within the proposed Project Area. As stated above, no breeding habitat has been identified during protocol surveys. Other projects in the area, such as the Bio-Park Project, would create additional potential habitat for the flycatcher. This project would also create habitat that would potentially benefit the flycatcher. The bosque wetlands would create more open water habitat and edge habitat, thus increasing benefits to fish and wildlife resources.

DISCUSSION

The Route 66 Project provides opportunities to restore some Rio Grande ecosystem biological components to benefit fish and wildlife resources. The project represents extensive coordination of ideas and plans on a multi-party level. Project implementation and reporting of the monitoring results would provide valuable information for future projects in a river-based ecosystem approach to restoration throughout the Middle Rio Grande.

The proposed restoration plan incorporates many of the recommendations from the Middle Rio Grande Ecosystem: Bosque Biological Management Plan (Crawford *et al.* 1993). The proposed plan would create wetlands within the Rio Grande riparian zone; and would sustain and enhance existing cottonwood communities as well as create new native cottonwood communities.

Activities that restore and enhance fish and wildlife habitat within the Middle Rio Grande are timely, as riparian and wetland habitats are scare and disappearing at an astonishing rate. About 90 percent of the historic wetland and riparian habitat in the Southwest has been eliminated (Johnson and Jones 1977). Hink and Ohmart (1984) found a wetland and riparian area decrease of 87 percent along the Rio Grande from 1919 t0 1982.

The value of riparian habitat is well known to resource managers because of the high diversity and abundance of animal species which rely on the ecosystem for its unique plant community types, hydrologic features, soil, topography, and other environmental features that do not exist in adjacent upland habitat. Many animals species are obligates (depending entirely on the riparian zone) while most are facultative (occurring in riparian habitat as well as in other habitat types).

The ecological attributes that contribute to the high value of riparian habitat should be maintained to preserve the value to wildlife include the following:

- Heterogeneity of plant communities and structure
- Predominance of woody plant communities
- Presence of surface water, soil moisture, and high water table
- Continuous, unfragmented corridors of habitat
- Sustainability

These factors should all be seriously considered in this as well as other restoration activities within the Middle Rio Grande ecosystem.

Because of the scarcity and high wildlife value of wetlands in the Southwest, wetland restoration and creation is desirable wherever possible. Managed wetlands in areas removed and protected from human, pets, and livestock would be most valuable to fish and wildlife. The easiest method to establish a wetland is to expand an existing one or to allow natural flow regimes to re-establish former wetlands. Wetlands with a variety of water depths, water movement through the wetland, small islands, an irregular water-land interface, and protection of adjacent uplands, are habitat requirements to produce a diverse healthy wetland. To maximize benefits to fish and wildlife resources, the Service recommends further exploration of wetland creation opportunities within the Middle Rio Grande.

Construction activities that result in unavoidable adverse impacts to fish and wildlife require the development of mitigation plans. These plans consider the value of fish and wildlife habitat affected. The Service has established a mitigation policy used as guidance in determining resource categories and recommending mitigation (46 FR: 7644-7663). The riparian bosque and

associated floodplain habitat within the Project Area are consistent with "Resource Category No. 2"; that is, habitats of high value that are relatively scarce or becoming scarce on a national basis or in the eco-region.

Although the Project Area contains a large amount of exotic species; overall, riparian and wetland habitats are classified in Category 2 because they are scarce. According to Johnson and Jones (1977), about 90 percent of the historic wetland and riparian habitat in the Southwest has been eliminated. Hink and Ohmart (1984) found a wetland decrease of 87 percent along the Rio Grande from 1918 to 1982. The Service mitigation policy states that the degree of mitigation should correspond to the value and scarcity of the fish and wildlife habitat at risk. Consequently, no net loss of in-kind habitat value should be the mitigation goal for this resource category. The Service believes that the proposed project not only meets, but exceeds the "no net loss of in-kind habitat" mitigation goal for this resource category. Therefore, no specific mitigation is needed for the project, as proposed.

Monitoring provides the feedback needed to establish protocols and make adjustments where and when necessary to achieve the desired results. Monitoring would be essential to the success of the Route 66 Project, as well as other USACE studies. Baseline data would be collected so that results can be quantified and compared. Wetland and bosque monitoring would include vegetation mortality, wildlife and vegetation species, groundwater and other environmental indicators. Post-project monitoring is a crucial requisite of the adaptive management process, as performance feedback may generate new insights on ecosystem response and provides a basis for determining the necessity or feasibility of subsequent design or operational modifications. Success should be measured by comparing post-project conditions to the restoration project objectives and pre-project conditions.

Another component of restoration of the Rio Grande ecosystem is water management. The single most important adverse impact to the fish and wildlife habitat within the Rio Grande ecosystem has been the change in the flow regime through water management. Present water management, including reduced peak releases, reduced volumes due to consumption, irrigation, improper timing of water releases, water salvage attempts, and water drainage has produced an overwhelmingly negative effect on fish and wildlife and their habitat.

All waste material would be disposed of properly at pre-approved or commercial disposal areas or landfills. Fuel, oil, hydraulic fluids and other similar substances would be appropriately stored away from the Rio Grande and must have a secondary containment system to prevent spills if the primary storage container leaks. All heavy equipment operating in or near river floodplain should carry an oil spill kit or spill blanket at all times. No refueling or staging shall occur in the bosque.

Permanent structures, access roads, staging, parking, refueling, and work areas could directly impact riparian habitats through removal and/or trampling. These impacts would be mitigated because access to all work areas would be along the levee. Staging would occur in adjacent open

areas that are available from the sponsor, MRGCD, or within the bosque if none is available. Additional access and subsidiary staging areas to facilitate construction activities would need to be coordinated with MRGCD, OSD, and the Bio-Park. No fueling would take place in the bosque.

The Service anticipates some minor short-term impacts to fish and wildlife resources associated with project construction. To ensure that federally listed species are not adversely impacted by the project, ESA section 7 consultation should be completed prior to construction. To minimize adverse impacts to birds protected under the Migratory Bird Treaty Act, tree stands or other adequately vegetated areas slated for grubbing or clearing should be surveyed for the presence of nesting birds during the general migratory bird nesting season of March through August. Disturbance to nesting areas should be avoided until nesting is completed. Vegetation clearing and construction related soil disturbances can cause sediment-laden runoff to enter waterways. To minimize impacts associated with erosion, the contractor should employ silt curtains without lead weights, coffer dams, dikes, straw bales, or other suitable erosion control measures. Construction related petrochemical spills can also negatively impact fish and wildlife resources. Therefore, measures should be implemented to minimize the likelihood of petrochemical spills. Spill procedures should be in place prior to construction to minimize impacts associated with unexpected spills. To ensure that the objectives of the project are met, post-construction monitoring of the Project Area should be conducted.

The Route 66 Project would provide the public a quality outdoor experience and would provide fish and wildlife benefits by restoring portions of the bosque to a condition nearer to natural and productive biotic community. Therefore, the Service believes the project would improve important long-term migratory bird habitat as well as resident fish and wildlife habitat within the Rio Grande corridor in Albuquerque.

RECOMMENDATIONS

The Service is encouraged by the restoration and conservation of valuable fish and wildlife resources represented by the proposed project. The following recommendations are provided by the Service to prevent and reduce adverse project effects on fish and wildlife resources during construction, operation, and maintenance of the proposed project:

1. Where possible, avoid construction during the migratory bird nesting season of March through August. Where that is not possible, tree stands or other adequately vegetated areas slated for grubbing or clearing should be surveyed for the presence of nesting birds prior to construction. Avoid disturbing nesting areas until nesting is complete.

2. Employ silt curtains without lead weights, cofferdams, dikes, straw bales or other suitable erosion control measures during construction.

3. Store and dispense fuels, lubricants, hydraulic fluids, and other petrochemicals outside the 100-year floodplain. Inspect construction equipment daily for petrochemical leaks. Contain and remove any petrochemical spills and dispose of these materials at an approved upland site. Park construction equipment outside the 100-year floodplain during periods of inactivity.

4. Ensure equipment operators carry an oil spill kit or spill blanket at all times and are knowledgeable in the use of spill containment equipment. Develop a spill contingency plan prior to initiation of construction. Immediately notify the proper Federal and state authorities in the event of a spill.

5. All work and staging areas should be limited to the minimum amount required. Existing roads and right-of-ways and staging areas should be used to the greatest extent practicable to transport equipment and construction materials to the project site, and described in the USACE's project description. Provide designated areas for vehicle turn around and maneuvering to protect riparian areas from unnecessary damage.

6. Backfill with uncontaminated earth or alluvium suitable for re-vegetation with native plant species.

7. Scarify compacted soils or replace topsoil and revegetate all disturbed sites with suitable mixture of native grasses, forbs, and woody shrubs.

8. Protect mature cottonwood trees from damage during clearing of non-native species or other construction activities using fencing, or other appropriate materials.

9. Use local genetic stock wherever possible in the native plant species establishment throughout the riparian area.

10. Continue coordination of Rio Grande water management activities that develop and maintain riverine and terrestrial habitats by mimicking the typical natural hydrograph. An intergraded management of flows from upstream reservoirs should be pursued by USACE for the purpose of protecting and enhancing the aquatic and terrestrial habitats along the Rio Grande.

11. Pursue and conduct floodplain management activities that discourage further development in the floodplain and address physical constraints to the higher flows that would be part of a natural hydrograph.

12. Explore expansion of the active floodplain of the Rio Grande at every opportunity.

13. Develop a coordinated program to monitor biological quality with emphasis on diversity and abundance of native species and ecosystem integrity with emphasis on restoring the

functional connection between the river and the riparian zone of the Middle Rio Grande ecosystem.

14. Develop partnerships with local schools, universities, or other interested groups to help address post-project monitoring and adaptive management needs (e.g., conduct periodic wildlife surveys, monitoring ecosystem response, etc.).

Figure 1

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APPENDICES

Appendix A. Common and Scientific Names of Plants That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Baccharis (N)	*Baccharis spp.*
Seepwillow (N)	*Baccharis glutinosa*
Coyote willow (N)	*Salix exigua*
Peachleaf willow (N)	*Salix amygdaloides*
Goodding's willow (N)	*Salix gooddingii*
Buttonbush (N)	*Cephalanthus spp.*
False indigo bush (N)	*Amorpha fruticosa*
New Mexico olive (N)	*Forestiera neomexicana*
Black locust (N)	*Robinia pseudo-acacia*
Boxelder (N)	*Acer negundo*
Chinaberry (I)	*Melia azedarach*
Rio Grande cottonwood (N)	*Populus fremonti*
White mulberry (I)	*Morus alba*
Russian olive (I)	*Elaeagnus angustifolia*
Salt cedar (I)	*Tamarix spp.*
Siberian elm (I)	*Ulmus pumila*
Tree-of-heaven (I)	*Ailanthus altissima*
Apache plume (N)	*Fallugia paradoxa*
Wolfberry (N)	*Lycium andersonii*
Fourwing saltbush (N)	*Atriplex canescens*
Virginia creeper (I)	*Parthenocissus inserta*
Phragmites (N)	*Phragmites communis*
Sago pondweed (N)	*Potamogeton pectinatus*
Sedge (N)	*Carex spp.*
Saltgrass (N)	*Distichlis stricta*
Spikerush(N)	*Eleocharis spp.*
Horsetail (N)	*Equisetum spp.*
Rush (N)	*Juncus spp.*
Bulrush (N)	*Scirpus spp.*
Sacaton (N)	*Sporobolus spp.*
Cattail (N)	*Typha latifolia*
Smartweed (N)	*Polygonum lapathifolium*
American milfoil (N)	*Myriophyllum exalbescens*
Yerba manza (N)	*Anemopsis californica*
Primrose (N)	*Oenothera spp.*
Fendler globemallow (N)	*Sphaeralcea fendleri*
Pricklypear (N)	*Opuntia spp.*
Buffalo gourd (N)	*Cucurbita foetidissima*
Spiny aster (I)	*Aster spinosus*
Golden currant (N)	*Ribes aureum*
Watercress (N)	*Nasturtium officionale*

(N=native, I=introduced or non-native)

Appendix B. Common and Scientific Names of Mammals That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Opossum	*Didelphis virginiana*
Desert shrew	*Notiosorex crawfordi*
Yuma myotis	*Myotis yumanensis*
Little brown bat	*Myotis lucifugus*
Long-legged myotis	*Myotis volans*
Silver-haired bat	*Lasionycteris noctivagans*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Spotted bat	*Euderma maculatum*
Townsend's big-eared bat	*Plecotis townsendii*
Pallid bat	*Antrozous pallidus*
Brazilian free-tailed bat	*Tadarida brasiliensis*
Desert cottontail	*Sylvilagus auduboni*
Black-tailed jackrabbit	*Lepus californicus*
Beaver	*Castor canadensis*
Gunnison's prairie dog	*Cynomys gunnisoni*
Colorado chipmunk	*Eutamias quadrivittatus*
Spotted ground squirrel	*Spermophilus spilosoma*
Rock squirrel	*Spermophilus variegatus*
Red squirrel	*Tamiasciurus hudsonicus*
Northern grasshopper mouse	*Onychomys leucogaster*
Deer mouse	*Peromyscus maniculatus*
White-footed mouse	*Peromyscus leucopus*
Piñon mouse	*Peromyscus truei*
Western harvest mouse	*Reithrodontomys megalotis*
Hispid cotton rat	*Sigmodon hispidus*
Norway rat	*Rattus norvegicus*
Muskrat	*Ondatra zibethicus*
New Mexican jumping mouse	*Zapus hudsonius luteus*
Ord kangaroo rat	*Dipodomys ordii*
Merriam kangaroo rat	*Dipodomys merriami*
Silky pocket mouse	*Perognathus flavus*
Plains pocket mouse	*Perognathus flavescens*
Yellow-faced pocket gopher	*Pappogeomys castanops*
Botta pocket gopher	*Thomomys bottae*
American porcupine	*Erethizon dorsatum*
Coyote	*Canis latrans*
Gray fox	*Urocyon cinereoargenteus scottii*
Raccoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
Long-tailed weasel	*Mustela frenata*
Mink	*Mustela vison*
Badger	*Taxidea taxus*
Bobcat	*Lynx rufus*
Mountain lion	*Felis concolor*
Mule deer	*Odocoileus hemionus*

Appendix C. Common and Scientific Names of Fish That May Occur in the Middle Rio Grande.

Common Name	Scientific Name
Gizzard shad (N)	*Dorosoma cepedianum*
Rainbow trout (I)	*Oncorhynchus mykiss*
Brown trout (I)	*Salmo trutta*
Northern pike (I)	*Esox lucius*
Red shiner (N)	*Cyprinella lutrensis*
Common carp (I)	*Cyprinus carpio*
Rio Grande chub (N)	*Gila pandora*
Rio Grande silvery minnow (N)	*Hybognathus amarus*
Fathead minnow (N)	*Pimephales promelas*
Flathead chub (N)	*Platygobio gracilis*
Longnose dace (N)	*Rhinichthys cataractae*
River carpsucker (N)	*Carpiodes carpio*
Flathead catfish (N)	*Pylodictis olivaris*
White sucker (I)	*Catostomus commersoni*
Rio Grande sucker (N)	*Catostomus plebeius*
Smallmouth buffalo (N)	*Ictiobus bubalus*
Black bullhead (I)	*Ictalurus melas*
Yellow bullhead (I)	*Ictalurus natalis*
Channel catfish (I)	*Ictalurus punctatus*
Western mosquitofish (N)	*Gambusia affinis*
White bass (I)	*Morone chrysops*
Green sunfish (I)	*Lepomis cyanellus*
Bluegill (N)	*Lepomis macrochirus*
Longear sunfish (I)	*Lepomis megalotis*
Largemouth bass (I)	*Micropterus salmoides*
White crappie (I)	*Pomoxis annularis*
Black crappie (I)	*Pomoxis nigromaculatus*
Yellow perch (I)	*Perca flavescens*

(N=native, I=introduced or non-native)

Appendix D. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Pied-billed grebe	*Podilymbus podiceps*
Common loon	*Gavia immer*
American white pelican	*Pelecanus erythrorhynchos*
Double-crested cormorant	*Phalacrocorax auritus*
Olivaceous cormorant	*Phalacrocorax olivaceus*
American bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Great blue heron	*Ardea herodias*
Great egret	*Ardea alba*
Snowy egret	*Egretta thula*
Little blue heron	*Egretta caerulea*
Cattle egret	*Bubulcus ibis*
Green-backed heron	*Butorides striatus*
Black-crowned night heron	*Nycticorax nycticorax*
White-faced ibis	*Plegadis chihi*
Snow goose	*Chen caerulescens*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Green-winged teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Northern pintail	*Anas acuta*
Cinnamon teal	*Anas cyanoptera*
Northern shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
Hooded merganser	*Mergus cuculatus*
Red-breasted merganser	*Mergus serrator*
Ruddy duck	*Oxyura jamaicensis*
Virginia rail	*Rallus limicola*
Sora	*Porzana carolina*
Common moorhen	*Gallinula chloropus*
American coot	*Fulica americana*
Sandhill crane	*Grus canadensis*
Whooping crane	*Grus americana*
Killdeer	*Charadrius vociferus*
Black-necked stilt	*Himantopus mexicanus*
American avocet	*Recurvirostra americana*
Solitary sandpiper	*Tringa solitaria*
Spotted sandpiper	*Actitis macularia*
Long-billed curlew	*Numenius americanus*
Forster’s tern	*Sterna forsteri*
Black tern	*Chlidonias niger*
Turkey vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Black-shouldered kite	*Elanus caeruleus*
Mississippi kite	*Ictinia mississippiensis*
Bald eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Cooper's hawk	*Accipiter cooperii*
Common black-hawk	*Buteogallus anthracinus*
Swainson’s hawk	*Buteo swainsoni*

Appendix D continued. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
American peregrine falcon	*Falco peregrinus anatum*
Ring-necked pheasant	*Phasianus colchicus*
Northern bobwhite	*Colinus virginianus*
Scaled quail	*Callipepla squamata*
Gambel's quail	*Callipepla gambelii*
Rock dove	*Columba livia*
White-winged dove	*Zenaida asiatica*
Morning dove	*Zenaida macroura*
Common ground-dove	*Columbina passerina*
Yellow-billed cuckoo	*Coccyzus erythropthalmus*
Greater roadrunner	*Geococcyx californianus*
Common barn-owl	*Tyto alba*
Great horned owl	*Bubo virginianus*
Burrowing owl	*Athene cunicularia*
Lesser nighthawk	*Chordeiles acutipennis*
Common nighthawk	*Chordeiles minor*
White-throated swift	*Aeronautes saxatalis*
Black-chinned hummingbird	*Archilochus alexandri*
Rufous hummingbird	*Selasphorus rufus*
Belted kingfisher	*Ceryle alcyon*
Northern flicker	*Colaptes auratus*
Olive-sided flycatcher	*Contopus borealis*
Western wood-pewee	*Contopus sordidulus*
Southwestern willow flycatcher	*Empidonax traillii extimus*
Black phoebe	*Sayornis nigricans*
Say's phoebe	*Sayornis saya*
Ash-throated flycatcher	*Myiarchus cinerascens*
Cassin's kingbird	*Tyrannus vociferans*
Western kingbird	*Tyrannus verticalis*
Eastern kingbird	*Tyrannus tyrannus*
Violet-green swallow	*Tachycineta thalassina*
Bank swallow	*Riparian riparia*
Cliff swallow	*Hirundo pyrrhonota*
Barn swallow	*Hirundo rustica*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Black-billed magpie	*Pica pica*
American crow	*Corvus caurinus*
Chihuahuan raven	*Corvus cryptoleucus*
Black-capped chickadee	*Parus atricapillus*
Verdin	*Auriparus flaviceps*
White-breasted nuthatch	*Sitta carolinensis*
Cactus wren	*Campylorhynchus brunneicapillus*
Black-tailed gnatcatcher	*Polioptila melanura*
Eastern bluebird	*Sialia sialis*
Western bluebird	*Sialia mexicana*
Hermit thrush	*Catharus guttatus*
American robin	*Turdus migratorius*

Appendix D continued. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Gray catbird	*Dumetella carolinensis*
Cactus wren	*Campylorhynchus brunneicapillus*
Black-tailed gnatcatcher	*Polioptila melanura*
Cactus wren	*Campylorhynchus brunneicapillus*
Black-tailed gnatcatcher	*Polioptila melanura*
Eastern bluebird	*Sialia sialis* Cactus wren *Campylorhynchus brunneicapillus*
Black-tailed gnatcatcher	*Polioptila melanura*
Eastern bluebird	*Sialia sialis*
Western bluebird	*Sialia mexicana*
Hermit thrush	*Catharus guttatus*
American robin	*Turdus migratorius*
Gray catbird	*Dumetella carolinensis*
Northern mockingbird	*Mimus polyglottos*
Curved-billed thrasher	*Toxostoma curvirostre*
Crissal thrasher	*Toxostoma dorsale*
European starling	*Sturnus vulgaris*
Bell's vireo	*Vireo bellii*
Warbling vireo	*Vireo gilvus*
Orange-crowned warbler	*Vermivora celata*
Virginia's warbler	*Vermivora virginiae*
Lucy's warbler	*Vermivora luciae*
Yellow warbler	*Dendroica petechia*
Yellow-rumped warbler	*Dendroica coronata*
Common yellowthroat	*Geothlypis trichas*
Wilson's warbler	*Wilsonia pusilla*
Yellow-breasted chat	*Icteria virens*
Summer tanager	*Piranga rubra*
Western tanager	*Piranga ludoviciana*
Northern cardinal	*Cardinalis cardinalis*
Pyrrhuloxia	*Cardinalis sinuatus*
Rose-breasted grosbeak	*Pheucticus ludovicianus*
Black-headed grosbeak	*Pheucticus melanocephalus*
Blue grosbeak	*Guiraca caerulea*
Lazuli bunting	*Passerina amoena*
Indigo bunting	*Passerina cyanea*
Painted bunting	*Passerina ciris*
Spotted towhee	*Pipilo maculatus*
Brown towhee	*Pipilo fuscus*
Dark-eyed junco	*Junco hyemalis*
Rufous-crowned sparrow	*Aimophila ruficeps*
American tree sparrow	*Spizella arborea*
Chipping sparrow	*Spizella passerina*
Lark sparrow	*Chondestes grammacus*
Black-throated sparrow	*Amphispiza bilineata*
Lark bunting	*Calamospiza melanocorys*
Lincoln's sparrow	*Melospiza lincolnii*
White-crowned sparrow	*Zonotrichia leucophrys*
Red-wing blackbird	*Agelaius phoeniceus*

Appendix D continued. Common and Scientific Names of Birds That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Western meadowlark	*Sturnella neglecta*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Brewer's blackbird	*Euphagus cyanocephalus*
Great-tailed grackle	*Quiscalus mexicanus*
Bronzed cowbird	*Molothrus aeneus*
Brown-headed cowbird	*Molothrus ater*
Orchard oriole	*Icterus spurius*
Northern oriole	*Icterus galbula bullockii*
House finch	*Carpodacus mexicanus*
Lesser goldfinch	*Carduelis psaltria*

Appendix E. Common and Scientific Names of Reptiles and Amphibians That May Occur in the Middle Rio Grande Floodplain.

Common Name	Scientific Name
Tiger salamander	*Ambystoma tigrinum*
Couch's spadefoot	*Scaphiopus couchii*
Plains spadefoot	*Spea bombifrons*
New Mexico spadefoot	*Spea multiplicata*
Great Plains toad	*Bufo cognatus*
Red-spotted toad	*Bufo punctatus*
Woodhouse's toad	*Bufo woodhousii*
Canyon treefrog	*Hyla arenicolor*
Western chorus frog	*Pseudacris triseriata*
Bullfrog (introduced)	*Rana catesbeiana*
Northern leopard frog	*Rana pipiens*
Yellow mud turtle	*Kinosternon flavescens*
Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Ornate box turtle	*Terrapene ornata*
Red-eared slider (introduced)	*Trachemys scripta*
Spiny softshell	*Trionyx spiniferus*
Collared lizard	*Crotaphytus collaris*
Leopard lizard	*Gambelia wislizenii*
Greater earless lizard	*Cophosaurus texanus*
Lesser earless lizard	*Holbrookia maculata*
Texas horned lizard	*Phrynosoma cornutum*
Roundtail horned lizard	*Phrynosoma modestum*
Desert spiny lizard	*Sceloporus magister*
Eastern fence lizard	*Sceloporus undulatus*
Tree lizard	*Urosaurus ornatus*
Side-blotched lizard	*Uta stansburiana*
Chihuahuan whiptail	*Cnemidophorus exsanguis*
Checkered whiptail	*Cnemidophorus grahamii*
Little striped whiptail	*Cnemidophorus inornatus*
New Mexico whiptail	*Cnemidophorus neomexicanus*
Western whiptail	*Cnemidophorus tigris*
Desert grassland whiptail	*Cnemidophorus uniparens*
Plateau striped whiptail	*Cnemidophorus velox*
Many-lined skink	*Eumeces multivirgatus*
Great Plains skink	*Eumeces obsoletus*
Texas blind snake	*Leptotypholps dulcis*
Glossy snake	*Arizona elegans*
Racer	*Coluber constrictor*
Ringneck snake	*Diadophis punctatus*
Great Plains rat snake	*Elaphe guttata*

Appendix E continued. **C**ommon and Scientific Names of Reptiles and Amphibians That May Occur in the Middle Rio Grande Floodplain.

Common Name	**Scientific Name**
Western hooknose snake	*Gyalopion canum*
Western hognose snake	*Heterodon nasicus*
Night snake	*Hypsiglena torquata*
Common kingsnake	*Lampropeltis getula*
Milk snake	*Lampropeltis triangulum*
Smooth green snake	*Liochlorophis vernalis*
Coachwhip	*Masticophis flagellum*
Striped whipsnake	*Masticophis taeniatus*
Bullsnake or gopher snake	*Pituophis melanoleucus*
Longnose snake	*Rhinocheilus lecontei*
Mountain patchnose snake	*Salvadora grahamiae*
Plains blackhead snake	*Tantilla nigriceps*
Blackneck garter snake	*Thamnophis cyrtopsis*
Wandering garter snake	*Thamnophis elegans*
Checkered garter snake	*Thamnophis marcianus*
Common garter snake	*Thamnophis sirtalis*
Western diamondback rattlesnake	*Crotalus atrox*
Blacktail rattlesnake	*Crotalus molossus*
Western rattlesnake	*Crotalus viridis*
Massasauga	*Sistrurus catenatus*